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# It's Neat to feel the Heat: How can we hold hands at a distance?

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**Abstract**

There is a growing body of work in HCI on the design of communication technologies to help support distance relationships. We build upon this work by presenting three different prototypes based on hand holding. This distinguishes itself by basing distance communication metaphors on elements of co-located hand-holding actions. We then present an evaluation of the prototypes based on a three-phase interview process with 12 participants. We conclude by discussing the combined evocative power of unique physical metaphors and memories in fostering romantic connections at a distance.

**Keywords**

Hand Holding, Design, Communication Systems, Intimate Communication

**ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.  
H.4.3. Communications Applications: Miscellaneous

**General Terms**

Design, Human Factors

## Introduction

There is a relatively rich history in HCI of communication systems designed to help support long distance relationships. Although much of this work focuses on domestic relationships (i.e. separated families) a body of work is starting to be formed around systems to support intimate couples.

We argue that such systems can be grouped into 3 broad categories, based on their design paradigm. These categories are abstract-, object- and behavior-based systems. Abstract systems are those which in essence have no metaphor behind their use. The Vio system [1] is a good example of this whereby a simple coloured circle is placed in each person's taskbar. The colour of the circle changes based on how frequently the person's partner clicked on their circle. The systems presented by Strong and Gaver in [2] are also abstract. They demonstrate how ambiguous movement and scent could be used to create a bond between a couple at a distance.

The second group of systems are those based around augmenting existing objects and turning them into communication systems. Dodge started this trend back in 1997 (along with an interest in tangible communication systems) when he presented his augmented bed [3]. Integrating in heat pads, sound and moving curtains, the idea was to connect couples who, for whatever reason, were sleeping in separate beds. ComSlipper, [4], is a personal artifact (namely slippers) which have been supplemented with technology to develop a rather delightful communication medium. Pressure points on either pair of slippers are connected to an LED and heat pad in the

other pair. Various interactions (such as foot tapping) lead to different outputs.

The third grouping is based on some form of behavioural mimicry at a distance. This is an area which thus far has received little attention. Mueller et al., [6], presented a device which used air pressure to create a hugging sensation when activated. Participants were positive about the concept but were concerned about the practicalities of using such a system. We have previously extended the concept of hugging to use heat as a metaphor for hugging [7]. The results indicated that such a device increased feelings of Social Presence. The characteristic feature of this third paradigm is to create a metaphor around a limited set of physical attributes that are rooted in a familiar intimate act. Our perspective is also semiotic: that the physical signals are only meaningful when embedded in elements of the relationship. We conceptualize the interpretation of signals within a close personal relationship as a matter of establishing the uniqueness of its origin, or 'personalization' to the remote other.

Progressing on from hugging, we consider hand holding. Within the HCI literature, the only work that we are aware of investigating hand holding is the technology probe carried out by O'Brien and Mueller [5]. We build on this work by presenting 3 prototype devices which build on the metaphor of hand holding. We then present an interview-based study looking at which prototype is preferred and why.

## The Hand-Holding Prototypes

The prototypes are called YourGlove, HotHands and HotMits. They use different sensory mediums (e.g.

movement or heat) and present the same metaphor in distinctive ways.

The YourGlove system is based around trying to mimic the movement of hand holding. The device is made up of a robotic hand which is moved by strings which, when pulled, cause the hand to contract. Mounted onto a drainpipe and with the addition of some motors, the system can then be controlled from the computer. Dressed in a familiar glove and the sleeve of a top given by the absent other, the YourGlove has the appearance of a hand that can be used to hold hands. Figure 1 shows the YourGlove system.



**figure 1.** The YourGlove system.

The HotHands system differs from YourGlove in that it uses heat rather than movement as the key physical signal in the medium of the hand. The system consists of two model hands, each a unique casting from each person in the relationship. A Peltier heat pump is then

mounted onto the top of each hand. Under each heat pump, a push switch is embedded into the hand. Using a phidget control board, the heat pump can be controlled in software. When a person places their hand onto their model hand, the other person's model hand warms up. This then represents holding hands. Figure 2 shows the HotHands system.



**figure 2.** The HotHands system.

The HotMits again use heat as the sensory medium. Instead of casting models of hands, unique imprints of the two people's hands are taken. Peltier pumps are then mounted into the palm of the imprint similarly to the HotHands system. Figure 3 shows the HotMits system.



**figure 3.** The HotMits system.

### Methodology

The prototypes were intended to explore the design potential around what it could mean to create a communication system based around holding hands. As exploratory systems, they are not mature enough to deploy into relationships. As such, a different technique of evaluation was needed.

We settled on a three-phase interview process. Firstly, participants were invited to read a scenario which explained the rationale for the device, including how it might be used and a picture of the initial prototype (Figures 1-3). Secondly, participants had a hands-on demonstration of the prototype device. Finally, a semi-structured interview was conducted with participants.

Along with changing the method of mimicking hand holding, we wanted to better understand the influence of partner uniqueness on the basic design ideas. Scenarios were thus devised in both device- and

person-centered alternatives. Device-centred scenarios were based around giving and receiving a gift in the form of a new remote hand-holding device. Person-centred scenarios described the co-creation of a remote hand-holding device. The YourGlove system was personalised by making it clear that the glove used was that of the persons' partner, not just a standard glove. The system could also include other personal items such as bracelets or rings. The HotHands system was personalised by making it clear that the molds were of the couples' hands rather than a standard mold. It was also made clear that the molded hands could be painted or decorated. Similarly, the HotMits were personalised by emphasizing that they were imprints of the couples' hands rather than a standardized imprint. Again it was made clear that the hands could be painted and decorated.

12 people took part in the study, 6 male and 6 female. The presentation of the 3 devices was counterbalanced for order. For each order condition, 1 male and 1 female took part. Of this pair, one got the person-focused scenario, counterbalancing for gender.

### Results

All participant interviews took approx. an hour. These interviews were audio recorded and then transcribed. The transcripts were then subjected to a three-reading thematic analysis to form a viewpoint on the interaction factors that were most salient to our participants.

In addition to more general questions; we specifically asked each participant which their favorite device was (see Table 1) and which devices they would use if commercially available (see Table 2).

Scenario	Gender	Your-Glove	HotHands	HotMits
<b>Person</b>	<b>Male</b>	2	0	1
	<b>Female</b>	0	0	3
<b>Device</b>	<b>Male</b>	0	3	0
	<b>Female</b>	0	1	2
<b>Total</b>		2	4	6

**Table 1.** The favourite device of each participant

Scenario		Your-Glove	HotHands	HotMits
<b>Person</b>	<b>Male</b>	3	3	2
	<b>Female</b>	0	3	3
<b>Device</b>	<b>Male</b>	0	2	2
	<b>Female</b>	0	3	2
<b>Total</b>		3 (25%)	11 (91%)	9 (75%)

**Table 2.** Devices participants 'would use again'

The first thing to note is the high percentage of people who said that they would use such a device (see table 2) indicating that these design concepts and prototypes are fulfilling a positive need people have for trying to help bridge the distance of their intimate relationship. As one participant said:

*"I think that if these had been available at the start of my university life, knowing I had 5 years of long distance then I possibly would have considered one of them" [P9 – DM].*

This reinforces our perspective on the general value of basing other-personalized tangible interfaces on co-located behavior.

If we look at the favorite data (Table 1) there is a clear preference for the two heating devices than for the YourGlove system. Those people who favored YourGlove identified it as being more "fun" or as the device which most resembled handholding.

There were a number of factors which seemed to determine people's preferences for the devices. The first is a general risk with the strength of a physical metaphor: generating a sense of alien agency or creepiness. The YourGlove system was generally thought to have too strong a metaphor and subsequently was considered a bit weird: *"you kind of expect it to be normal and then it's not so then it's like: oh no, I don't like that one..." [P4 – PF].*

Despite this risk, most of our participants saw that the value was not in trying to replace handholding but in connecting the people in the relationship:

*"it's more about forming that personal connection than the specific action" [P10 – DM].*

*"it would mean your partner is thinking about you which I think is always nice if someone does something out of the blue and then you suddenly realize oh someone's thinking of me..." [P4 – PF]*

One of the findings which is slightly surprising is the impact that memories had on how the devices were thought of. Some people had deeply personal memories which they associated with a particular device. [P6 – DF] for example favored the HotHands system as:

*"it reminds me of a personal memory, just of being in the cinema, it's such a long time ago... I think it was on our second date and my hand was here and he put his hand on mine and I don't know... just for me, perhaps not other people, that's why I liked it and when I saw it I thought wow".*

Alternatively, [P3 – PF] liked the HotMits concept as:  
*" 'cause we kind of did it when we went on holiday in the sand, it might have been feet, and then like wrote our names in the sand and took a photo of that so that's kind of a similar concept I guess..."*

There were also cultural memories that several people mentioned which seemed to make them more comfortable with the HotMits system. These memories included children making hand-prints in paint and the imprints in concrete of celebrities in Hollywood. This is unsurprising as being aware of these similar activities demystify the concepts that we are talking about. What we are really trying to achieve is to tap those deeper personal memories which were accompanied with a visceral attachment to a particular device.

The power of the different metaphors was expected; indeed that is why we developed several different prototypes. The positive role of unique memories that are stimulated by strong physical metaphor adds a valuable dimension to the design problem.

### Further Work

Our participants understood the 'unique physical' designs for tangible presence technologies but there are a number of challenges for the approach we have reported. Firstly, the devices, especially the cast hands, were not actually made unique for our individual

participants. Their responses were to the ideas behind our devices rather than to their individualized realization. The second is that they did not use the devices as part of their communication ecology.

Given these limitations, we plan to run field studies using a number of the devices to gain a deeper understanding of how the devices are used in people's lives and the impact that they might have on their long-distance intimate relationships.

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